

Identifying the Competence Requirements for Human Capital at Different Types of Digital Printing Companies - Case studies at Graphic Arts Companies in Sweden and Greece

Anastasios E. Politis, Lic.Tech.*

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Abstract

The installation of digital printing presses and systems for traditional companies involved in the field of Graphic Arts causes significant changes in the production workflow and organizational structure of these companies.

One important aspect to be considered regarding this development is if those employees working with digital printing need to learn new skills and/or update the skills they already possess. Recent surveys conclude that for those working with digital printing, there most certainly exists a need to redefine the human capital needed (competence and other requirements) in order to be successful and effective in this field.

Research on digital printing installations has revealed that digital printing presses and systems are operating at three main types of companies: Pre-press companies, printing works, and copy shops – companies working with photocopying.

The aim of this paper is to examine if there exist differences among the employees of these types of companies with regards to existing competence and experience.

*The Royal Institute of Technology – KTH, Stockholm Sweden

INTRODUCTION AND RESEARCH OBJECTIVES

The installation of digital printing presses and systems in traditional Graphic Arts companies causes significant changes in the production workflow and organizational structure of these companies. (Taylor 2000). One important aspect to take into consideration with regards to this development is if these employees need to learn new skills and/or update the skills they already possess.

An important issue that needs to be investigated is what type of competency characteristics and requirements are needed for existing and future employees at companies that have installed digital printing systems. According to a survey carried out by Grafiska (Grafiska Företagens Förbund – the Swedish Graphic Employers Federation), there is certainly a need for a new definition of competency characteristics and requirements of human capital as it concerns the employment in digital printing systems (Grafiska, 1999).

Further research on human capital competence for digital printing has brought about a new issue that is very interesting: Does the installation of digital printing systems have the same effect on different types of Graphic Arts companies? Moreover, by extending this question to human capital, do competence requirements vary among different types of Graphic Arts companies?

Research on the structure of print media processing performed by traditional Graphic Arts companies, as well as new companies that start to print digitally, conclude that there exist three main types of companies, where digital printing presses and systems are installed (DPP, 2001), (Taylor, 2000):

- Pre-press enterprises.
- Printing works.
- Copy shops - photocopying companies.

The main objective of this research is to explore if there are differences in competence and the expertise of human capital of those employed at these three types of companies, as well as to identify the skills required for employees yet to be recruited.

STRUCTURE AND CHARACTERISTICS OF DIGITAL PRINTING

Technological developments that are taking place within the information and communication industry affect the structure of the Graphic Arts and media sector, in particular towards the direction of common production environments for printing and electronic media. However, thus far the printing media seems to retain its competitive edge against the electronic media (Comprint, 1998). Regarding production in the field of the printing media, digital printing methods

and systems show a rapid development and increasing importance among printing processes (Juhola, 1998).

According to a recent Pan-European survey conducted by Pira International, approximately 25% of those printers participating in the survey expected to install a digital press within five years. An additional 50% did not rule out the possibility. With this surge, digital printing could almost triple its share of the printing process market from 4% to 11% by 2010 (Demand, 2001).

The primary motivation for this expected surge in spending is the potential of being able to penetrate new markets. This trend is especially prevalent among printing providers who are anxious to exchange their traditional market products for complete digitally-enhanced services for their customers. Decreased run lengths, variable data, and faster turnaround times are also factors that will help motivate the purchase of digital printing presses.

The two markets where these factors are most likely to intersect are probably books and commercial printing. Both of these markets are expected to achieve high growth rates for products printed during the next few years that make use of digital technology (Demand, 2001).

DIGITAL PRINTING - CORE MARKETS

According to Holland, commercial digital printing markets cover a wide variety of printed jobs. In recent years we have seen enormous improvements in achievable printing quality and productivity allied with a significant fall in the cost of digital printing. These developments have led to the increased market share that digital print now enjoys and which was estimated to be 9% of the total printing volume in Europe during the year 2000. Moreover, Holland states that digital printing will continue to increase its market share (Holland, 2000), (Demand, 2001).

Another important aspect with respect to increased market share concerns advances in technology. They not only allow prepress-oriented companies, but also DTP bureaus and other types of companies such as photocopy companies to engage in digital printing. Offset printing companies also invest in digital printing and try to examine its implications on traditional offset printing (DPP, 2001).

The performance of digital printing will be on a par with conventional printing processes by the year 2005. By 2010, 20% of printing production will be done using digital processes. These are two of the key findings of a recent in-depth study, *The Future of Print*, published by Pira International and Prima. Thus, the

message is clear that this new technology should not be ignored or underestimated by the printing and publishing industries.

Another recent Pira International report, *Digital Printing Capital Investment Trends in Europe*, cites the reasons for this growth in digital technology. The report is based on primary research conducted in eight major European countries that, excluding packaging printers, included printers (444), pre-press bureaus (90), copy shops (81) and advertising agencies (55). All were asked about current and future plans for investing in digital printing technology along with details concerning the applications and printing sectors that they were targeting.

The total number of digital presses (including direct imaging offset presses) already installed by these companies was 358, with printers representing the largest share (201), followed by copy shops (98). It is assumed that the rest of the digital machinery was installed in pre-press companies and advertising agencies. This compares with a total of 2,308 conventional printing presses installed by the companies.

The conclusions of the report forecast that the projected number of installed digital color presses – that is machines which are capable of variable image printing – in the EU countries, plus Norway and Switzerland, will increase from around 1,330 in the year 2000 to 1,500 in 2001, 1,775 in 2002, 2,000 in 2003 and 2,600 in 2005 (IFRA, 2001).

Based on the Pira survey, the conclusion is that pre-press, printing and copy-shop-photocopying companies are the main types of companies where digital printing systems and/or presses have been installed. According to the study, the market share of digital printing is dominated by commercial printing. Advertising, catalogues, books, and manuals are the main product groups using printing. In Table 1 the percentage of each group is presented:

<i>Product</i>	<i>Digital printing output in terms of volume</i>
Promotional/ Advertising material	56,2%
Catalogues	16,7%
Books	7,4%
Manuals	7,1%
Others	12,6%

Table 1: Digital printing product groups

Source: Pira International report, "Digital Printing Capital Investment Trends in Europe" (Holland, 2000), (IFRA, 2001).

The Pira study indicates that commercial printing is the main product field for digital printing and that promotional material is the most popular market targeted by current digital printers, followed thereafter by catalogues and manuals.

Schneider and Schlözer argue that, with respect to printing processes, there is no doubt that the market share for digital printing will increase. However, in the world of printing, ample space still remains for offset printing, especially concerning more competitive presses that include on-press imaging.

The business model for printing companies must also be expanded, among other things, in order to make digital printing profitable. Printing should not be the only service a printing company offers. The more digital data used by a company, the better the chances of a printer to become the complete outsourcing solution for a customer. This could incorporate customers for all types of visual publishing, such as non-print services offering complete solutions, including offset and digital print. According to Schneider and Schlözer, this might be the largest growth sector for the Graphic Arts industry (Schneider and Schlözer, 2001).

Based on these characteristics concerning digital printing installations, the survey to be carried out has focused on the following types of different companies: Pre-press, printing (mainly offset,) and companies offering traditional photocopying services (copy shops).

COMPETENCE REQUIREMENTS FOR DIGITAL PRINTING

The competence and skills of employees are considered to be one of the influential factors concerning digital printing installation and production. One of the issues that has arisen for Graphic Arts companies that decide to install digital printing equipment concerns the integration of personnel into this new environment. How can the company ensure an efficient and effective integration of personnel possessing traditional qualifications into a new working environment and workflow production? Another important aspect is the competence orientation of new personnel for digital printing (Koblinger, 1998).

Previous research on this issue has concluded that there are certain new requirements that are necessary with regards to competence characteristics of human capital for digital printing production, both on the technical and management level (DPP, 2001). According to the conclusions of this survey, digital printing creates a number of special requirements and tasks for the employees (existing and potential) that include:

- Knowledge of the technical capabilities of digital printing equipment/systems.
- The ability to understand and explain to customers the added value of documents that are printed digitally.
- Efficient management and administrative capability in order to handle a large number of small jobs with very short turnaround times, tight deadlines, and fast delivery.

Furthermore, the knowledge of Graphic Arts, experience, and expertise are considered important for digital printing production environments, but the implementation of digital printing also demands an extensive range of new skills. These skills can be categorized as follows: general computer knowledge, knowledge of pre-press (color and color management, data files and formats), digital workflow production and management skills (BPIF, 2000).

In a survey initiated in 1995 by the social partners in the Swedish Graphic Arts industry (Grafiska Företagens Förbund - the Swedish Graphic Employers' Federation, Tidningsutgivarna – the Swedish Newspaper Publishers Association, and the Grafiska Fackförbundet – the Swedish Graphic Workers Trade Union), it was shown that competence requirements were changing significantly within the Graphic Arts and newspaper industry in Sweden. Structural changes were taking place on all levels within the companies and affected company administration, work organization, technology, and competency (Danielson et al., 1995).

As it is stated in the survey, “In order to achieve an organization that is more open with closer channels for information and decision-making, companies strive to flatten the work organization, reducing the number of middle managers and delegating responsibility and authority. The flattened organization creates a series of new and, above all, higher competency demands for all those employed by the company. Co-workers are given more responsibility for the work they carry out and thereby become more involved and highly motivated, and many have customer contact”.

RESEARCH METHODOLOGY

The research methodology used was based both on the study of literature as well as on interviews with Graphic Arts companies. Most of the literature used for this study concerned research and analyses from the industry that concerned the competence of human capital for digital printing (COMES, 2000), (Koblinger, 1998).

In order to extract results on competence requirements of human capital for digital printing, it was decided to carry out interviews with companies in the

Graphic Arts industry. A questionnaire was developed for this purpose. This questionnaire is similar to the one used previously for the recent research study for the identification of qualifications for human capital for digital printing production (DPP, 2001). The questionnaire used for the present survey gives more focus to the competence requirements of existing and potential employees at different types of companies that have digital printing systems installed.

The companies chosen for the interviews were selected according to the following criteria: They should be traditional companies belonging to one of the three different types of companies that were identified for the survey during the planning stages.

Additionally, they should have an orientation in commercial printing, and should have recently installed digital printing equipment or systems. For this purpose, the intention was not to carry out research at a large number of companies; rather the objective was rather to extract qualitative results concerning competence characteristics of human capital. Therefore, the decision was made to interview six different companies.

Based on the prerequisites mentioned above, a decision was made to interview three companies from Sweden and three from Greece. One company from each of the different types of Graphic Arts companies (pre -press, printing and photocopying) was selected in each respective country. The reason why these were chosen was to be able to compare the outcome of the interviews, both for content and cross-culturally.

The Swedish companies were selected with assistance from consultants in the Swedish Graphic Arts industry. The Greek companies chosen for this survey were selected through personal contacts of the researcher and records from suppliers of digital printing systems.

The companies participating in the survey are classified according to Table 2 below:

COUNTRY	TYPE OF ENTERPRISES		
	<i>PRE-PRESS</i>	<i>PRINTING</i>	<i>PHOTOCOPYING</i>
GREECE	1	1	1
SWEDEN	1	1	1
TOTAL	2	2	2

Table 2: Origin and type of companies interviewed

The objective of the interviews was to identify the competence requirements of human capital for companies where digital printing equipment/systems have been installed. In addition, an investigation of the possible differences with

regards to characteristics of human capital among the different types of companies would be carried out. The interviews were carried out between May and September 2001.

The aim of the interviews was to qualify the results of the research obtained from the questionnaire, which consisted of four sections (Appendix). The first section contained four questions relating to general company information such as type of the company, number of employees turnover, and investments (Section A).

The second section consisted of two questions requesting feedback on digital printing installations, mainly the type of the digital printing equipment/ system used. (Section B).

The third section consisted of four questions addressing the implications of the installation and work with the digital printing systems on the company (Section C). The fourth section included questions on human capital competence for digital printing production (Section D).

The questions were augmented with in-depth interviews, and the opinions of those interviewed were further discussed. The results of the survey were analyzed and combined with the findings of the research from literature in order to obtain final conclusions. This approach was applied in order to relate the quantitative and qualitative research methodology and obtain as reliable results as possible (Bryman, 1995), (Koulouvari, 2001).

RESULTS

As can be derived from the questionnaires, all six companies are small and medium-sized, employing less than 250 people. However, in the Greek Graphic Arts industry a company having more than 50 employees is considered to be large. 50% of the companies employ between 21 and 50 people. The number of employees at each of the remaining companies is from 6-10, 11-20, and more than 50 employees.

With reference to turnover for the year 2000, three companies had a turnover of 1 to 2 million Euros; one company had a turnover of between 2 and 5 million Euros, and 2 companies had a turnover of more than 5 million Euros. Investments for new equipment for the year 2000 were about 62,000 Euros for the Greek pre-press company, and up to 800,000 Euros for the Swedish pre-press company.

Concerning the first year when a digital printing system was installed, all of the Swedish companies had installed their systems in 1996, whereas two of the Greek companies installed their systems in 1998 and one in the year 2000. 5 out

of 6 machines installed are for color printing and roll-to-sheet machines. The last system is a black/white, sheet-to-sheet machine. All 6 machines are for double-sided printing. In addition, 5 of the machines are stand-alone, and only one is equipped with an on-line finishing system.

The installation of the digital printing system caused problems relating to management issues and the efficient production workflow for all six companies. However, the installations caused less confusion for the marketing/sales personnel (4 out of 6 companies).

4 out of 6 companies had problems with accurate cost estimations for digital printing production, and 50% reported problems with pricing for work printed digitally. Everyone gave the same answer with regards to the issue of defining exactly what could be produced by the digital printing system. 4 out of 6 companies reported that they had difficulty in explaining to the customer the advantages and added value of digitally- printed documents.

Furthermore, the majority of companies reported that no personnel was dismissed as a result of the installation of digital printing equipment. Only one company reported that it had dismissed personnel as a result of a digital installation. In addition, 5 out of 6 companies answered that the installation of the digital printing system did not replace part of production; instead the operation of the digital printing machine made the production workflow complete. All six companies reported that they offered new services/products to existing customers and gained new customers as well.

Digital printing installations and competence characteristics

Lack of competence in personnel has been reported in the field of digital printing, job definition, and organization (all six companies), workflow management (4 out of 6 companies), data files output and finishing binding (3 out of 6 companies). A lack of competence was not identified for proofing and pre-press operations.

Furthermore, the installation of a digital printing system required both the recruitment of new personnel and auxiliary training for existing personnel at 5 out of 6 companies. All of the Swedish companies recruited new personnel, as did two of the Greek companies. One of the Greek companies has also carried out an additional training program.

With reference to new personnel and what type of competence should be possessed by the new recruits, 3 out of 6 companies reported that they had recruited personnel possessing computer skills; 2 companies recruited personnel

that possessed skills in Graphic Arts, and the Swedish printing company replied that it had recruited personnel that had both computer and Graphic Arts skills which were oriented towards printing.

When it came to auxiliary education, 5 out of 6 companies employed in-house training, whereas the Swedish printing company used both in-house and external training.

Definition of core qualifications for human capital employed at the companies

This part of the interview required answers from the companies concerning what qualifications they considered to be important for human capital in digital printing production for machine operators and management (production workflow, sales/marketing, customer relationships).

Regarding the machine operator level, the following qualifications have been reported as important by the majority of the companies: digital formats and standards (TIFF, JPEG, Postscript, PDF, CIP4), pre-press operations, ripping, color management, and customer needs. Knowledge of traditional printing processes, imposition, printing materials and substrates, as well as quality control and digital printing machine maintenance are considered to be important by 50% of the companies.

Web-Internet skills, proofing, knowledge of networking, and digital workflow applications (e.g. Agfa Apogee, Prinergy and PDF) have been reported as important from only 1 out of 6 companies. No substantial differences were identified among the different types of companies or with regards to country at this stage.

With regards to management level, the interviews resulted in the following findings:

Pre-press, printing and finishing production workflow, knowledge of computers, marketing-management skills, customer relationship management and the added value of digital printing are considered to be important attributes of human capital for those employed on management level (4 or 5 out of 6 answers). Furthermore, Internet skills and business-to-business work are considered important by 3 out of 6 companies, whereas the knowledge of Graphic Arts, ICT, and expertise in quality assurance systems were considered important by only 2 out of 6 companies.

With regards to the degree of difficulty in recruiting suitable personnel for operating and managing digital printing equipment or systems, the findings are

as follows: On the machine operator level, the answers provided by the three Swedish companies varied from easy to not very difficult, in contradiction with the three Greek companies where the answers varied from difficult to very difficult.

With regards to the management level, the Swedish printing company was the only one to report that it did not find it very difficult to recruit personnel. The other 5 companies answered that it was difficult to very difficult to recruit personnel. The other two Swedish companies reported that it was difficult, whereas the three Greek companies answered that it was very difficult to recruit suitable personnel.

With reply to the question if an offset printer is a more suitable person for operating a digital printing press, 3 out of 6 companies answered that he/she was not more suitable than other personnel. The two printing- oriented companies answered that an offset printer is suitable for operating a digital printing press but that he/she should possess computer and ripping skills. Finally, the remaining Swedish photocopying company answered that an offset printer is suitable for operating a hybrid – direct imaging machine (e.g. Karat or Quickmaster) and not suitable for operating other types of digital printing equipment (e.g. Xeikon or Indigo).

With regards to the human capital (technical or managerial) needed for those who will be employed in a digital printing work environment in the future, 5 out of 6 companies answered that personnel should have competence that is related to traditional Graphic Arts technology if they are going to be working with digital printing working. Finally on the question of how companies regard the concept of "Investment in Human Capital", all 6 companies answered that this is a very important issue.

DISCUSSION

Implications of the installation of digital printing equipment with regards to the different types of companies

The initial implication relating from the installation of digital printing is that this technology functions as a catalyst, by thrusting companies oriented towards different markets (e.g. the copy shops, which are primarily oriented towards black/white photocopying), into the new market of commercial and promotional printing. Commercial printing, the printing of advertisements, books, and catalogues are considered to be proper product segments of digital printing. Companies with different market orientations now compete in the same market segment of print media production thanks to the new technical possibilities made available by digital printing.

A first conclusion from the interviews with regards to the implications at the different types of companies as a result of the installation of digital printing systems is that, indeed, some differences exist, but they are not considered to be very important.

More specifically, with regards to pre-press companies, it is interesting to mention that during the initial investment phase, both before and directly after the installation of the digital printing equipment, the companies were concerned with fulfilment. However, a change gradually took place, and this leads to the conclusion that as these companies became more familiar with the equipment, they became more confident about entering the market of commercial printing.

Another interesting finding is that both the pre-press companies that were interviewed in Greece and in Sweden have also installed large format digital printing systems and are expanding through the installation of finishing and binding equipment.

The companies involved in photocopying (copy shops) have regarded investments in digital printing as an opportunity to improve their product range, from simple copy services to document and print media production. These companies regard the investment in digital printing systems as a natural progression towards total and complete production, mainly moving from xerographic systems to more sophisticated digital printing.

Printing companies hold a slightly different view of digital printing than that of pre-press and copy shops. According to both interviews, the installation of digital printing systems was aimed at enhancing the production range of the sheet offset printing machines.

The results show that double-sided printing is the type of digital printing that is done at those companies interviewed after installation of a digital system, and that they are stand-alone systems (5 out of 6 companies). It is interesting that the owners and managers of the companies interviewed were of the opinion that stand-alone systems were better because they offered flexibility for printing different types of printed matter. It is only if production is geared towards books or a certain printing size that digital printing installations were equipped with in-line finishing systems.

According to the answers provided, separate finishing departments had to be developed for pre-press companies. In some cases, finishing was developed with inexpensive systems, thereby leading to an increase in productivity and with more flexibility.

The survey also revealed that changes took place in management and production workflow at most of the companies interviewed. Fewer changes were required in the area of sales and marketing. A contradiction to this exists however. Although most of the companies stated that no changes were required with respect to the sales and marketing departments, the installation of digital printing systems caused problems for the sales and marketing personnel.

Once more, 50% of the companies reported having difficulty in defining what could be produced using digital printing systems. 4 out of 6 companies had a problem trying to explain the advantages and added value of documents printed digitally to their customers. In addition, companies involved in photocopying reported having difficulty with estimating costs, defining the production range, and describing for customers the advantages of digital printing. Of course this is only natural since these companies are treading new ground and using a new production process.

Surprisingly, the pre-press companies had a great deal of difficulty in defining the product range for digital printing as well as explaining its advantages and added value for customers. Just the reverse, the companies oriented towards printing did not have any problem with the above-mentioned issues. The survey revealed that printing-oriented companies were better at integrating digital printing within their management, workflow, production, and marketing.

Digital printing installation has not replaced any other part of existing production at any of the companies interviewed. Instead, it enhanced the production workflow of the companies. All of the companies offered new services and products, and gained new customers as well. None of the companies reported that it had changed its main product orientation as a result of the introduction of digital printing with respect to production, services, customers and the print media market.

All of the companies that participated in the survey expanded their product range. Pre-press companies increased their production not only in digital printing (whereas ready-to-print files were imported for production), but also in traditional processes such as scanning, image and page processing.

Competence of human capital for digital printing

Concerning digital printing itself, most of the companies interviewed experienced a lack of competency by their personnel with regards to job organization and workflow management. Concerning the traditional orientation of the different companies, the survey showed that pre-press and companies involved in photocopying found that they lacked competency in finishing and binding.

The results of the companies oriented towards printing were different. One printing company only showed a lack of competency in job organization, whereas the other company experienced a lack of competency in workflow management, data files output, and ripping.

The results of the survey showed that none of the companies lacked competency in color printing and proofing, something logical for pre-press and printing-oriented companies, but not for photocopying-oriented companies (copy shops).

An important aspect that was pointed out from some of those interviewed was that it was quite easy for unskilled personnel to operate digital printing presses after a brief period of in-house training. Moreover, the majority of new personnel recruited at 5 out of the 6 companies had computer skills, something much welcomed.

With regards to auxiliary training for existing personnel, internal in-house training was carried out by the majority of the companies. This indicates that the education in digital printing offered by approved institutions of learning is inadequate, both in Sweden and Greece in particular.

Finally, with regards to management level, no correlation could be found from the answers for the same types of companies. The majority of the companies stated that knowledge of the added value of digital printing, customer relationships, pre-press, printing, finishing and production workflow were the most important factors with which to be concerned.

Differences between Greek and Swedish companies

The most significant difference between Greek and Swedish companies has to do with the education, training and recruitment of skilled personnel. All of the Greek companies stated that it was difficult to very difficult to recruit or even retrain personnel, both on the machine operator as well as on the management level. A course in digital printing does not exist in Greece, neither within the formal public educational system nor within the private sector.

Just the opposite, for those Swedish companies interviewed it was easier to recruit skilled personnel, at least on the machine operator level. This finding reflects the structural problems of the Greek educational system and its difficulty to adapt and offer courses in new demanding fields.

Both the Swedish and the Greek companies interviewed shared similar viewpoints concerning the problems and implications of the installation of digital printing systems. They also hold similar opinions with regards to the consideration of human capital in relation to digital printing.

Another significant difference between the two countries is the year when the first digital printing installation occurred: In Sweden, all three companies installed their systems in 1996, whereas two of the Greek companies first installed their systems in 1998, and the third Greek company did likewise in the year 2000. This finding brings to the foreground how sluggish the Greek printing industry still is today and reflects the degree of delay in adaptation to new technology.

However, a closer observation reveals that the delay in installation of digital printing systems in Greece, as compared to Sweden, can be due to a difficulty in defining and segmenting the print media market rather than to a problem with the technology itself.

CONCLUSIONS

Based on the survey, an initial conclusion is that different types of companies do not seem to show important variations either on the implications of digital printing installations or with regards to human capital competency requirements. Furthermore, the companies generally show more differences with regards to what type of companies they are and the products they produce, and fewer differences cross-culturally.

In addition, in spite of the fact that the main business of the companies surveyed differed from one another, digital printing systems gradually managed to be integrated into the structure of each of the companies. Digital printing completed the production workflow for all of the different companies, offering new services and an increase in new customers.

The installation of digital printing systems has led to the recruitment of new personnel. In all cases, training was implemented through internal, in-house courses offered by the supplier of the equipment.

The concept of the "Investment in Human Capital" is regarded to be "very important." This statement declares the increasing importance of human capital for the further development of companies involved in Graphic Arts.

Regarding human capital competency characteristics for digital printing, it can be concluded that not only technical skills but, indeed, new, upgraded, and combined skills together with overall competency are required. Competence requirements expand the narrow fields of technical skills and involve other knowledge areas including customer relationships, management, teamwork, and life-long learning.

The survey has certain limitations as it only concerns the number of companies interviewed and the range of questions answered. The reliability of the findings in this survey could be improved if additional interviews were to be carried out with other companies in the Graphic Arts industry.

Nevertheless, it was possible to draw a number of conclusions since the survey concerns itself with the implications of digital printing installations on three different types of companies within the field of Graphic Arts. In addition, trends regarding competence requirements and characteristics of the human capital used in digital printing could be determined.

FURTHER RESEARCH

Further research is required with regards to the issue of training and education, as well as the need for an accurate description of the competence required for digital printing, especially on the management level. Another significant issue is the digital printing business models that have been defined so far. These need to be described more precisely with reference to their structure, characteristics, and classification. This is a prerequisite for the determination of the competence characteristics and requirements of human capital for those presently employed or to be recruited in new business models using the digital printing systems.

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APPENDIX:

QUESTIONNAIRE ON COMPETENCE CHARACTERISTICS OF HUMAN CAPITAL FOR DIFFERENT TYPES OF COMPANIES WITH DIGITAL PRINTING INSTALLATIONS

A: GENERAL COMPANY DATA:

1. Position of contact person: Owner, Manager, Other
2. Originally the main business orientation of your enterprise was:
Pre-press, Printing, Photocopying
3. Number of employees: 1-5, 6-10, 11-20, 21-50, 50-100, over 100
4. Turnover for the year 2000: (For the whole company activity)
Less than 250,000 Euros, 250,000-500,000 Euros, 500,000-1 million Euros, 1 to 2 million Euros, 2 to 5 million Euros, over 5 million Euros.
5. Investments in new equipment for the year 2000 (In Euros):

B: INFORMATION ON DIGITAL PRINTING

6. When was the first digital printing system installed in your company? (year):
7. Which kind/type of system have you installed? (You can give more than one answer):
 - 7.1 Black/White printing, Color printing
 - 7.2 Roll to Sheet, Sheet to Sheet, Roll to roll,
 - 7.3 One side printing, Double-sided printing
 - 7.4 Stand alone printing machine, With on line finishing system
 - 7.5 Other, please specify:

C: IMPLICATIONS FROM THE INSTALLATION OF DIGITAL PRINTING EQUIPMENT / SYSTEM IN YOUR COMPANY:

8. Did the installation of the digital printing system require any changes at the following (You can give more than one answer):
Production workflow, Management, Sales – marketing,
Other, please specify:

9. Did the installation of the digital printing system cause:

(You can give more than one answer):

- The dismissal of existing personnel YES (Y), NO(N)
- Problems concerning the efficient production workflow Y, N
- Confusion to the marketing /sales, personnel Y, N
- Problems concerning the accurate cost estimating of digital printing Y, N
- Problems concerning the pricing of digitally printed jobs Y, N
- Problems in defining what exactly could be produced by the digital printing system Y, N
- Difficulties in explaining to the customer the advantages and the added value of digitally printed documents Y, N

10. Did the installation of the digital printing system:

- Replace a part of your production Y, N
- Complete the production workflow Y, N

(You can give more than one answer)

11. With the installation of a digital printing system in your company:

- You offered new services – products to your old customers Y, N
- You gained new customers Y, N

Please give your comments if necessary:

D: COMPETENCE OF HUMAN CAPITAL FOR DIGITAL PRINTING

12. Considering the installation of the digital printing machine/system at your enterprise, you found out lack of personnel competence in the following fields: (You can give more than one answer)

Job organization-definition, Workflow management, Pre-press operations, Data-files output (Postscript-Ripping), Imposition, Proofing, Printing - Color printing, Finishing-binding, Other, please specify:

13. Did the installation of the digital printing system require:

The employment of new personnel, The further training of existing employees

13a. In the case of employment of new personnel, which kind of competence did he/she have in general:

Graphic Arts/media skills, Computer skills, Other, please specify:

13b. In the case of further training action, which one did you follow?

A seminar offered by an external organization

An internal in-house training offered by the machine vendor/supplier

A distance learning activity

A combination of the above, please specify:

14. Which of the following key/core qualifications do you consider as important for human capital in digital printing production (machine operator level) and the management level (production workflow, sales/ marketing, customer relationship), related with the type of your enterprise? (You can give more than one answer)

Machine operator level:

Traditional printing processes, Pre-press applications, Color management, Web - Internet skills, Ripping, Networking knowledge, Digital formats and standards (e.g. TIFF, JPEG,

Postscript, PDF, CIP4), Digital workflow (e.g. JDF, – Agfa - Apogee, Adobe - PDF, Heidelberg - Prinergy), Imposition, Proofing, Machine maintenance, Binding and finishing processes, Quality control, Materials (Paper, inks, toners, other substrates etc.), Customer needs, Other, please specify:

Management level:

Graphic Arts/media knowledge, Pre-press-printing-finishing production workflow, Computer knowledge, Web - Internet skills, Marketing-management skills, Information and telecommunication knowledge, Quality assurance systems expertise, Added value of digital printing, CRM – Customer Relationship Management, Business to business, Other, please specify:

15. How difficult was for your enterprise to find people fitting your requirements, in accordance with the operation and managing of the digital printing machine/system?

Machine operator level:

Very difficult, Difficult, Not very difficult, Easy, Very easy

Managerial level:

Very difficult, Difficult, Not very difficult, Easy, Very easy

16. Do you consider that the offset printer is a more suitable person to operate a digital printing machine? Y, N

Finally, as a general consideration please provide your opinion and comments to the following:

17. Do you consider that the human capital that is going to work within the digital printing working environment and systems, either technical or managerial, should have competence related with the traditional Graphic Arts Technology? Y, N

18. How important do you find the "Investment in Human Capital" concept for your company? Very important, Important, Rather important, Rather not important, Not important at all

Please, give any other comments or opinions that are important for you.